

REMARKS

Claims 1-15 are of record.

The Examiner is correct in noting the errors on page 12 of the application. This arose due to a translation error of the French PCT application into English. This error has been corrected.

Throughout the Specification, the terms “Energized Line De-icer” and “ELD” have been changed to “On-load Network De-Icer” and “ONDI”, respectively.

Corrections also have been made to the Specification at page 8, lines 5-14, page 9, lines 1-2 and page 15, lines 18-19.

None of the amendments adds new matter.

Claim 10 stands rejected as anticipated over the newly cited reference to Arnold, FR 2,745,430. Claim 10 has been amended to make it clear that the invention applies to a distribution of transmission networks for alternating current. Claim 10 calls for selectively (and typically) operating circuit breakers in the network to make the connections of the network segment into the loop being de-iced. Claim 10 also calls for an apparatus that produces a fixed angular offset of the current in the loop.

Arnold discloses a de-icing method for conductors supplying power to an electrical power supply bus, or railing elements for bridge cranes, hoists or similar electrical mobile handling devices. The power supply levels of such devices are low and the electrical equipment used to provide the power required for de-icing such devices involves no exceptional behavioral considerations compared to medium and high voltage alternating current energy transport and distribution networks in which the subject invention is used.

Arnold provides a de-icing system based on AC or DC current flow in conductors. Applicant’s method used to de-ice selected segments of an electrical distribution and transport line uses the Joule effect.

Arnold mentions a decoupled power supply made of a three-phase isolating transformer or three independent single-phase isolating transformers having secondary windings, each connected by adapted linking cables. Claim 10 calls for use of an apparatus that can produce a fixed angular offset of current between its terminals when connected in the loop. Assuming (to an uncertain degree) that the transformers referred to by Arnold are possibly capable of being the same

as the claimed "apparatus", i.e., a phase shifting transformer (PST) or an arrangement of transformers forming collectively a PST, even if Arnold has not used that term, Arnold adds special conductors (adapted linking cables) to the conductors to be de-iced to form a loop and allows the induction of de-icing current by the PST. Applicant's de-icing method does not use the special adapted linking cables.

In Arnold, the conductors to be de-iced are short and present only a resistive impedance to the de-icing current. This is clearly visible in Figs. 2B and 2D of Arnold where the series voltage $dV1$ at the terminals of phase 1 of the uncoupled power supply (4) is perfectly in phase (parallel) with the heating current that it induces.

Applicant's invention uses a PST, or other type of power controller, for de-icing electric distribution and transport lines. At high voltage, these lines exhibit impedances whose inductive component can be more than 10 times higher than the resistive component. Flow of de-icing currents having intensities that may be 2 to 3 times higher than the current for which the lines have been designed causes a great consumption of reactive power in the lines and important voltage drops due to the inductive components of the line impedances. Applicant's method can function under such conditions, such as indicated on page 9, line 27 - page 10, line 4 of the current application, by installation of a capacitor in parallel with the PST provides a means to controllably produce reactive power. Arnold's consideration to network voltage drops is strictly limited to the use of quadrature injected voltages. Applicant also uses quadrature injected voltages, but this is not enough to prevent voltage collapses and render de-icing possible in the case of long transmission lines. In such a case, it is mandatory that reactive power needs of the network be adequately fulfilled by further using series and/or shunt capacitors means. The absence of the reactive power management in the Arnold patent illustrates the fact that the field of application contemplated by Arnold is totally different from the field of the present invention. Reactive power management under de-icing is explicitly addressed in applicant's invention.

Applicant's invention that uses a PST, or other type of power controller, is used for de-icing energy distribution and transport lines that can be very long, even more than 100 km. The lines carry AC high-voltage levels at 315 kV. It is technically inconceivable to add "adapted linking cables", as Arnold does, with his device that is supposed to function as the apparatus capable of

producing an angular offset (e.g., a PST) as recited in the claims to allow the circulation of the de-icing current.

Claim 10 calls for connecting the apparatus that produces the fixed angular offset in circuit with the loop being de-iced. This factor alone makes the §102 rejection over Arnold inapplicable.

Another distinction exists between amended claim 10 and Arnold. In Arnold, since the circuit to be de-iced is short and relatively simple, Arnold does not have to use circuit breakers to reconfigure the set of bus or railing to de-ice. Circuit breakers are proposed by Arnold for use only when de-icing one conductor at a time. Whatever the case, no circuit breakers are proposed or required as in the invention of claim 10 for configuring the segments of the network into loops to be de-iced. This intervention cannot be considered in the case of Arnold because, strictly speaking, there is no electric network but only a set of bus or railing elements supplying, for example, a bridge crane.

In summary, applicant's method as set forth in claim 10 relies upon the integration of a de-icing method in an existing network, made of a group of lines. Contrasted to this, the teachings of Arnold require the installation of a group of equipment dedicated to the de-icing of only one set of bus or railing elements. In Arnold, there must be as many de-icing systems as there are sets of buses to be de-iced even if there is one or several bridge cranes, hoists or similar electrical mobile handling devices. Applicant's invention is not so restricted.

Applicant's method uses an apparatus that produces the angular offset to accomplish the de-icing of several on-load (energized) line segments and even if the apparatus is installed physically many kilometers away from the segments to be de-iced. Arnold cannot accomplish this.

In summary, applicant's novel method as set forth in claim 10 has the following features and advantages:

- selectively using circuit breakers to form a loop made of several line segments in a classical electric network;
- using an apparatus, such as a power controller, to produce the angular offset, the loops can be formed with the power controller, for example a PST, installed in one of the stations of the network;

- these loops can be formed so as to concentrate the load currents of the network in a particular line segment for the purpose of de-icing and reducing the cost of the power controller;
- the loop can be implemented without interrupting the power supply of the loads of the network;
- the loop can be implemented without producing a Ferranti effect;
- the loop can include line segments at different voltage levels;
- the loop can be formed while avoiding operation of switches having contacts out in the open and thus sensitive to ice accretion;
- the de-icing currents can flow in the loop without producing a voltage collapse as a result of an appropriate production of reactive power;
- the de-icing currents can typically flow in the equipments of the station without producing overheating of the equipments;
- a sole power controller can perform the sequential de-icing of several electric lines.

The above description highlights the fact that applicant's invention is not limited to a mere device for de-icing a specific line. Applicant's invention also includes management of an existing network in order that de-icing be applied to a number of transmission lines, which is a very unconventional approach in the field and is completely out of Arnold's field of endeavor. Not only do network reactive power need to be adequately fulfilled, but also a logistic must be put in place for operating a number of circuit breakers located in a number of substations for de-icing the transmission lines without disrupting the active power supply to the loads connected to the substations. Demonstration of the power management aspect of the invention is where almost all research and development efforts had been invested. It took months to conclude on its feasibility. From applicant's point of view, this shows that as simple as it may see, the claimed method is not obvious to skilled engineers familiar with all the technical constraints imposed by power systems.

Accordingly, claim 10 is not anticipated by, and patentability distinguishes over, Arnold. Therefore, claim 10 should be allowed.

Claims 1-4 and 7-15 are rejected over Pelletier, U.S. 5,907,239 in view of Arnold, FR 2,745,430. Claims 7 and 8 have been cancelled as being redundant in view of the amendments to claim 1.

Claim 1 also has been amended to recite that the method is to be used in an alternating current voltage distribution or transmission networks. Claim 1 also calls for selectively (and typically) operating circuit breakers in the network to make the connections of the network segments into the loop being de-iced. The failure of Arnold to have these features is discussed above.

Regarding Pelletier, its field of application is strictly limited to power flow control in transformers or lines. In the case of transformers, Pelletier uses special transformers that act as constant current sources. For this reason, they contribute poorly to the possible fault currents, which allow adding supplementary transformers (classical or not) in the station without exceeding the breaking capacity of the existing circuit breakers. In the case of an electric line, Pelletier teaches how the power flow control function of a classical PST is assisted by addition of a reactive element in parallel with it, which allows increasing the power flow of the line beyond what could be done with the PST alone. Pelletier discloses no other functions than these. Moreover, the implementation of the functions of Pelletier is achieved by acting over equipment circumscribed in a single station. Pelletier nowhere mentions or suggests how to achieve, as per applicant's invention as set forth in claim 1, a de-icing method for electric lines that involves operations on circuit breakers, capacitor banks and power controllers which may involve stations located more than 100 km apart from one another.

The Examiner recognizes that the principal reference to Pelletier does not provide the motivation for applying his teachings to a method for de-icing. The Examiner now relies on the newly cited Arnold reference to describe a method for de-icing that couples a transformer to a section of an electric line. It is somewhat unusual to find motivation in a secondary reference (Arnold) instead of in the primary reference (Pelletier). In constructing the motivation, the Examiner considers the field of endeavour of Pelletier and Arnold to be analogous since both provide electrical power through a transformer coupled to an electric line. Then the Examiner considers that there would be motivation to use the combination of references "to increase current in the lines, thereby increasing losses along the lines to create heat and melt ice. Applicant respectfully disagrees.

It is submitted that Arnold does not provide the motivation alleged by the Examiner for applying the teachings of Pelletier to a method for de-icing. There is simply no technical link between Pelletier and Arnold. The environments in which Pelletier and Arnold are applied and the considerations involved are completely different. That is, Pelletier and Arnold are not properly combined and the rejection fails on this ground alone.

Further, the novel de-icing method of the application as set forth in independent claims 1 and 10 exceeds the context of Arnold relating to de-icing bus or railing elements for bridge cranes, hoists or similar electrical mobile handling devices. This is explained in detail above.

It is submitted that even an improper combination of Pelletier with Arnold would not lead to the de-icing method of claim 1, from which claims 2-4 and 7-9 depend. This also holds true for claims 11-13, which depend from claim 10, discussed in detail above. Pelletier does not reach or suggest a de-icing method and has no elements to be used for de-icing and even less to the concentration of current to perform a de-icing operation. Pelletier does not disclose any steps of any method for de-icing electric lines. Arnold does not teach de-icing selected segments of energized electrical lines of an energy transport or distribution network. Arnold neither teaches nor suggests connecting segments of energized electrical lines to form a loop. Arnold fails on these points for the simple reason that it is totally unrelated to energy transport and distribution networks and the equipment found in such networks.

Therefore claims 1-4 and 11-13 are clearly patentable over the (improper) combination of references and should be allowed.

Claims 5-6 which depend from claim 1 are rejected over Pelletier in view of Arnold and further in view of Couture, U.S. 6,396,172. Couture is cited for teaching switching devices.

Couture relates to the concentration of load current at the level of the bundles of conductors of an energy transport line to heat the conductors by Joule effect. Concentration of load currents for the purpose of heating conductors of electric lines was known for a long time prior to Couture. In the present invention, concentration of the load currents can be also achieved. However, as indicated on page 12, lines 6-8 of the subject application, such a feature does not constitute an indispensable condition to the de-icing operation as set forth in claim 1. Concentration of the load currents is a strategy that can be advantageously used by the network operator to

facilitate the implementation of applicant's de-icing method to the same degree as, for example, the use of shunt capacitor banks to ensure an appropriate support of the network voltages when the lines to be de-iced are long and that the de-icing currents are high.

The addition of Couture does not cure the failure of the combination of Pelletier and Arnold to meet the subject matter of independent claim 1. Accordingly, claims 4 and 5 also are patentable over the cited references.

As shown above all of the claims clearly and patentably distinguish over the art of record and should be allowed.

Prompt and favorable action is requested.

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